

What Is Claimed Is:

1. An exposure method in which an exposure processing of a specific process is performed to each of a plurality of photosensitive objects, said method comprising:

a first process in which estimate values of positional information used to align each of a plurality of divided areas on a photosensitive object with a predetermined point are calculated by a statistical computation, using actual measurement values of positional information of a plurality of specific divided areas selected from said plurality of divided areas on said photosensitive object; and

a second process in which with respect to a plurality of measurement divided areas on said photosensitive object including at least said plurality of specific divided areas, a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of measurement divided areas is calculated respectively at predetermined intervals, based on an actual measurement value of positional information of each of said plurality of measurement divided areas and on each of said estimate values, and

judgment is made about the necessity of update of correction information based on magnitude of one of said non-linear component of positional deviation amount calculated of each of said plurality of measurement divided areas and a variation amount of the non-linear component, said correction information

being used to correct a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of divided areas on said photosensitive object.

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2. The exposure method of Claim 1, further comprising:
a third process in which an update processing to update said correction information is performed when it is judged that update is necessary in said second process; and

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a fourth process in which exposure is performed controlling a position of said photosensitive object based on the estimate value of positional information of each of said plurality of divided areas and said correction information that is latest.

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3. The exposure method of Claim 2 wherein
in said third process, when the update processing of said correction information is performed, among said plurality of divided areas, at least a part of remaining divided areas excluding said plurality of measurement divided areas are to be new measurement divided areas, and said correction information is updated using a non-linear component of positional deviation amount from said individual fiducial position of each of said plurality of divided areas calculated based on actual measurement values of positional information of all measurement divided areas including the new measurement divided areas and on said estimate values.

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4. The exposure method of Claim 3 wherein

said new measurement divided areas are determined based on evaluation results of said non-linear component of positional deviation amount of each of said plurality of divided areas included in said correction information before
5 update.

5. The exposure method of Claim 3 wherein
said new measurement divided areas are determined based on evaluation results of one of said non-linear component
10 of positional deviation amount of each of said plurality of measurement divided areas calculated in said second process and a variation amount of the non-linear component.

6. The exposure method of Claim 1 wherein
15 said intervals are one of intervals of a predetermined number of said photosensitive objects and intervals of a predetermined period of time.

7. The exposure method of Claim 1 wherein
20 as said plurality of measurement divided areas on said photosensitive object, only said plurality of specific divided areas can be designated.

8. The exposure method of Claim 1 wherein
25 as said plurality of measurement divided areas on said photosensitive object, at least a part of remaining divided areas can be designated in addition to said plurality of specific divided areas.

9. The exposure method of Claim 1 wherein

said correction information is one of a correction map and a correction function.

5 10. An exposure method in which an exposure processing of a specific process is performed to each of a plurality of photosensitive objects, said method comprising:

 a process in which estimate values of positional information used to align each of a plurality of divided areas on a photosensitive object with a predetermined point are
10 calculated by a statistical computation, using actual measurement values of positional information of a plurality of specific divided areas selected from said plurality of divided areas on said photosensitive object;

15 a process in which

 with respect to a plurality of measurement divided areas on said photosensitive object including at least said plurality of specific divided areas, a non-linear component of positional deviation amount
20 from an individual fiducial position of each of said plurality of measurement divided areas obtained from each actual measurement value of positional information and each of said estimate values is evaluated at predetermined intervals, and

25 at least one of the number of new measurement divided areas to be added and an arrangement thereof is determined based on the evaluation results;

 a process in which correction information related to a non-linear component of positional deviation amount from

an individual fiducial position of each of said plurality of divided areas on said photosensitive object is updated, using said non-linear component of positional deviation amount of each of said plurality of divided areas on said photosensitive object, said non-linear component of positional deviation amount being calculated based on actual measurement values of positional information of all measurement divided areas including said new measurement divided areas and on said estimate values; and

10 a process in which exposure is performed controlling a position of said photosensitive object based on the estimate value of positional information of each of said plurality of divided areas and said correction information after update.

15 11. The exposure method of Claim 10 wherein the evaluation of said non-linear component of positional deviation amount of each of said plurality of measurement divided areas is performed, taking into consideration at least one of magnitude and a dispersion degree of said non-linear component of positional deviation amount of each of said plurality of measurement divided areas in said correction information before update.

25 12. The exposure method of Claim 10 wherein the evaluation of said non-linear component of positional deviation amount of each of said plurality of measurement divided areas is performed, using a predetermined evaluation function.

13. The exposure method of Claim 10 wherein
said plurality of divided areas on said photosensitive
object are grouped into a plurality of blocks in advance, and
the evaluation of said non-linear component of
5 positional deviation amount of each of said plurality of
measurement divided areas is performed with respect to each
block.

14. The exposure method of Claim 10 wherein
10 said intervals are one of intervals of a predetermined
number of said photosensitive objects and intervals of a
predetermined period of time.

15. The exposure method of Claim 10 wherein
15 as said plurality of measurement divided areas on said
photosensitive object, only said plurality of specific
divided areas can be designated.

16. The exposure method of Claim 10 wherein
20 as said plurality of measurement divided areas on said
photosensitive object, at least a part of remaining divided
areas can be designated in addition to said plurality of
specific divided areas.

25 17. The exposure method of Claim 10 wherein
said correction information is one of a correction map
and a correction function.

18. A device manufacturing method including a

lithographic process wherein

in said lithographic process, an exposure processing of a specific process is continuously or intermittently performed to each of a plurality of photosensitive objects
5 using the exposure method in any one of Claims 1 to 17.

19. An exposure apparatus that performs an exposure processing of a specific process to each of a plurality of photosensitive objects, said apparatus comprising:

- 10 a moving body that holds a photosensitive object;
a detection system that detects actual measurement values of positional information of any divided areas among a plurality of divided areas on said photosensitive object held on said moving body;
- 15 a computation unit that calculates estimate values of positional information used to align each of said plurality of divided areas with a predetermined point by a statistical computation, using actual measurement values of positional information of a plurality of specific divided areas among
20 said plurality of divided areas on said photosensitive object detected by said detection system;
- a judgment unit that
with respect to a plurality of measurement divided areas on said photosensitive object including
25 at least said plurality of specific divided areas, calculates a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of measurement divided areas respectively at predetermined intervals, based on an

actual measurement value of positional information of each of said plurality of measurement divided areas detected by said detection system and each of said estimate values of positional information calculated by said computation unit, and

judges the necessity of update of correction information based on magnitude of one of said non-linear component of positional deviation amount calculated of each of said plurality of measurement divided areas and a variation amount of the non-linear component, said correction information being used to correct a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of divided areas on said photosensitive object;

an updating unit that performs a processing to update said correction information when said judgment unit judges that update is necessary; and

a control unit that controls a position of said photosensitive object via said moving body based on the estimate value of positional information of each of said plurality of divided areas and said correction information that is latest, when exposing each of said plurality of divided areas.

20. The exposure apparatus of Claim 19 wherein said updating unit comprises:

a determining unit that determines at least a part of remaining divided areas excluding said

plurality of measurement divided areas among said plurality of divided areas on said photosensitive object, as new measurement divided areas; and

5 a calculating unit that calculates a non-linear component of positional deviation amount from said individual fiducial position of each of said plurality of divided areas on said photosensitive object as new correction information, based on actual measurement values of positional information of all measurement
10 divided areas including actual measurement values of positional information of the new measurement divided areas detected by said detection system and on said estimate values.

15 21. The exposure apparatus of Claim 20 wherein said determining unit determines said new measurement divide areas based on evaluation results of one of said non-linear component of positional deviation amount of each of said plurality of measurement divided areas calculated by
20 said judgment unit and a variation amount of the non-linear component.

22. The exposure apparatus of Claim 19 wherein said intervals are one of intervals of a predetermined
25 number of said photosensitive objects and intervals of a predetermined period of time.

23. The exposure apparatus of Claim 19, wherein a first mode in which only said plurality of specific

divided areas are designated as said plurality of measurement divided areas on said photosensitive object, and a second mode in which said plurality of specific divided areas and at least a part of remaining divided areas are designated as said
5 plurality of measurement divided areas on said photosensitive object are settable.

24. An exposure apparatus that performs an exposure processing of a specific process to each of a plurality of
10 photosensitive objects, said apparatus comprising:

a moving body that holds a photosensitive object;

a detection system that detects actual measurement values of positional information of any divided areas on said photosensitive object held on said moving body;

15 a computation unit that calculates estimate values of positional information used to align each of a plurality of divided areas with a predetermined point by a statistical computation, using actual measurement values of positional information of a plurality of specific divided areas among
20 said plurality of divided areas on said photosensitive object detected by said detection system;

an evaluation unit that

with respect to a plurality of measurement divided areas on said photosensitive object including
25 at least said plurality of specific divided areas, evaluates a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of measurement divided areas at predetermined intervals, based on an actual

measurement value of positional information of each
of said plurality of measurement divided areas
detected by said detection system and each of said
estimate values of positional information calculated
5 by said computation unit, and

determines at least one of the number of new
measurement divided areas to be added and an
arrangement thereof, based on the evaluation results;
an updating unit that updates correction information
10 related to a non-linear component of positional deviation
amount from an individual fiducial position of each of said
plurality of divided areas on said photosensitive object,
using said non-linear component of positional deviation
amount of each of said plurality of divided areas on said
15 photosensitive object, said non-linear component of
positional deviation amount being calculated based on actual
measurement values of positional information of all
measurement divided areas including actual measurement values
of positional information of the new measurement divided areas
20 detected by said detection system and on said estimate values;
and

a control unit that controls a position of said
photosensitive object via said moving body based on the
estimate value of positional information of each of said
25 plurality of divided areas calculated by said computation unit
and said correction information that is latest, when exposing
each of said plurality of divided areas.

25. The exposure apparatus of Claim 24 wherein

said plurality of divided areas on said photosensitive object are grouped into a plurality of blocks in advance, and

said evaluation unit performs the evaluation of said non-linear component of positional deviation amount of each
5 of said plurality of measurement divided areas with respect to each block.

26. The exposure apparatus of Claim 25 wherein
said intervals are one of intervals of a predetermined
10 number of said photosensitive objects and intervals of a predetermined period of time.

27. The exposure apparatus of Claim 25, wherein
a first mode in which only said plurality of specific
15 divided areas are designated as said plurality of measurement divided areas on said photosensitive object, and a second mode in which said plurality of specific divided areas and at least a part of remaining divided areas are designated as said plurality of measurement divided areas on said photosensitive
20 object are settable.

28. The exposure apparatus in any one of Claims 19 to
27 wherein
said correction information is one of a correction map
25 and a correction function.

29. A program that makes a computer for control of
an exposure apparatus that performs an exposure processing
of a specific process to each of a plurality of photosensitive

objects execute a predetermined processing, said program making said computer execute:

5 a procedure in which estimate values of positional information used to align each of a plurality of divided areas on a photosensitive object with a predetermined point are calculated by a statistical computation, using actual measurement values of positional information of a plurality of specific divided areas selected from said plurality of divided areas on said photosensitive object; and

10 a procedure in which

with respect to a plurality of measurement divided areas on said photosensitive object including at least said plurality of specific divided areas, a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of measurement divided areas is calculated respectively at predetermined intervals, based on an actual measurement value of positional information of each of said plurality of measurement divided areas and on each of said estimate values, and

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judgment is made about the necessity of update of correction information based on magnitude of one of said non-linear component of positional deviation amount calculated of each of said plurality of measurement divided areas and a variation amount of the non-linear component, said correction information being used to correct a non-linear component of positional deviation amount from an individual fiducial position of each of said plurality of divided

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areas on said photosensitive object.

30. A program that makes a computer for control of an exposure apparatus that performs an exposure processing
5 of a specific process to each of a plurality of photosensitive objects execute a predetermined processing, said program making said computer execute:

a procedure in which estimate values of positional information used to align each of a plurality of divided areas
10 on a photosensitive object with a predetermined point are calculated by a statistical computation, using actual measurement values of positional information of a plurality of specific divided areas selected from said plurality of divided areas on said photosensitive object; and

15 a procedure in which

with respect to a plurality of measurement divided areas on said photosensitive object including at least said plurality of specific divided areas, a non-linear component of positional deviation amount
20 from an individual fiducial position of each of said plurality of measurement divided areas obtained from each actual measurement value of positional information and each of said estimate values is evaluated at predetermined intervals, and

25 at least one of the number of new measurement divided areas to be added and an arrangement thereof is determined based on the evaluation results;

a procedure in which correction information related to a non-linear component of positional deviation amount from

an individual fiducial position of each of said plurality of divided areas on said photosensitive object is updated, using said non-linear component of positional deviation amount of each of said plurality of divided areas on said photosensitive object, said non-linear component of positional deviation amount being calculated based on actual measurement values of positional information of all measurement divided areas including said new measurement divided areas and on said estimate values; and

10 a procedure in which exposure is performed controlling a position of said photosensitive object based on the estimate value of positional information of each of said plurality of divided areas and said correction information after update.